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ABSTRACT

This report contains the findings of the National Science Foundation's (NSF's) Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1981. The survey was mailed to 563 universities and colleges, including all institutions that granted a graduate science or engineering (S/E) degree, as well as to academic institutions with $50,000 or more in separately budgeted research and development (R&D) expenditures. Areas considered in the report include sources of R&D support, expenditures related to character of work and S/E fields, largest R&D performers, and research equipment expenditures. Selected findings indicate that: separately budgeted R&D expenditures totaled $6.8 billion, a 12 percent increase in current dollars over 1980 levels; in the context of national research effort, excluding national expenditures for development, academic instititutions performed 27 percent of the U.S. total in 1981, up slightly from their 25 percent share in 1974; Federal agencies continued to sponsor two-thirds ($4.5 billion) of academic R&D activities; basic research performance by universities/colleges totaled $4.6 billion, a 3 percent real increase over 1980 levels; and the most rapid current-dollar growth in major S/E disciplines occurred in mathematical/computer sciences, psychology, and the physical sciences. The life sciences accounted for more than one-half of total R&D expenditures. (JN)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 MARCH 21, 1983 NSF 83-304

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Real Growth Rate of Academic R&D Expenditures Slowed to 2% in FY 1981

This report contains the findings of the National Science Foundation's (NSF's) Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1981. The survey was mailed to 563 universities and colleges including all institutions that granted a graduate science or engineering (S/E) degree, as well as to academic institutions with $50,000 or more in separately budgeted research and development (R&D) expenditures. Estimates made by NSF for R&D expenditures of nonrespondent institutions represented less than 5 percent of total academic R&D spending in fiscal year (FY) 1981. All R&D expenditures data presented in this report refer to FY spending levels. Data are presented in current dollars except where specified as constant 1972 dollars. In the absence of a reliable R&D cost index, the gross national product (GNP) implicit price deflator developed by the Department of Commerce is used to convert current dollars to constant 1972 dollars. The use of the GNP deflator can only approximate changes in the costs of R&D performance.

Highlights

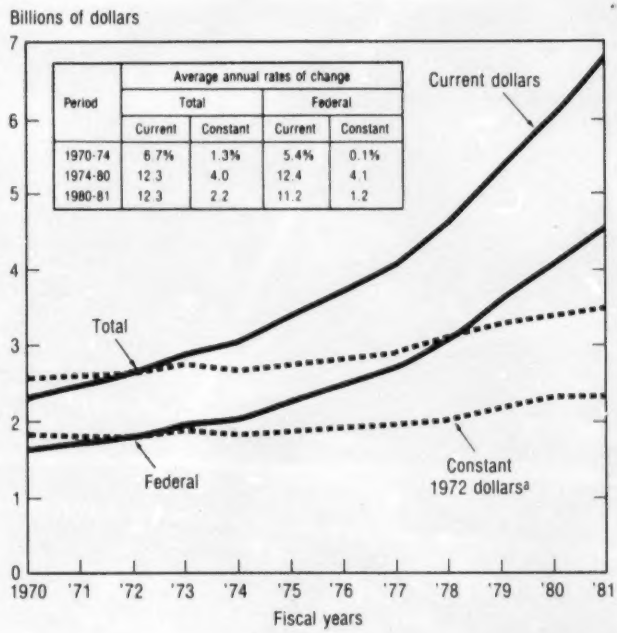
• Separately budgeted R&D expenditures at universities and colleges totaled $6.8 billion in FY 1981, a 12-percent increase in current dollars over 1980 levels. This amount actually represented an increase of only 2 percent in constant dollars, however, or about one-half the average annual growth rate since 1974 (chart 1). Preliminary estimates for 1982 indicate that the level of academic R&D expenditures was at, or below, 1981 totals in constant-dollar terms.[1]

• In the context of the national research effort, excluding the national expenditures for development, academic institutions performed 27 percent of the U.S. total in 1981, up slightly from their 25-percent share in 1974.[2]

• In 1981 Federal agencies continued to sponsor two-thirds, or $4.5 billion, of academic R&D activities (up 11 percent over 1980). Constant-dollar increases in non-Federal support, up 4 percent, far outpaced the growth in federally financed expenditures, up only 1 percent. All of the non-Federal growth was traced to increases in support from industry and the institutions' own funds.

• Basic research performance by universities and colleges in 1981 total $4.6 billion, a 3-percent real increase over 1980

Chart 1. Total and federally financed R&D expenditures at universities and colleges



[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

[1]National Science Foundation, *National Patterns of Science and Technology Resources, 1982* (NSF 82-319) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1982), table 1, p. 24.
[2]*Ibid.*, tables 1-4, pp. 24-27.

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levels. Almost no real growth occurred in spending levels for applied research and development, which had risen at an average annual rate of 7 percent since 1974.

- The most rapid current-dollar growth in the major S/E disciplines occurred in the mathematical/computer sciences, psychology, and the physical sciences, up 13 percent to 15 percent. The life sciences, up 12 percent, accounted for more than one-half of total R&D expenditures.

- Of the total expenditures for separately budgeted R&D activities, universities and colleges expended approximately $420 million on S/E research equipment, which constituted 6 percent of separately budgeted R&D expenditures. This amount increased about 15 percent from 1980 to 1981. Engineering and the physical and life sciences together accounted for more than 80 percent of total research equipment expenditures.

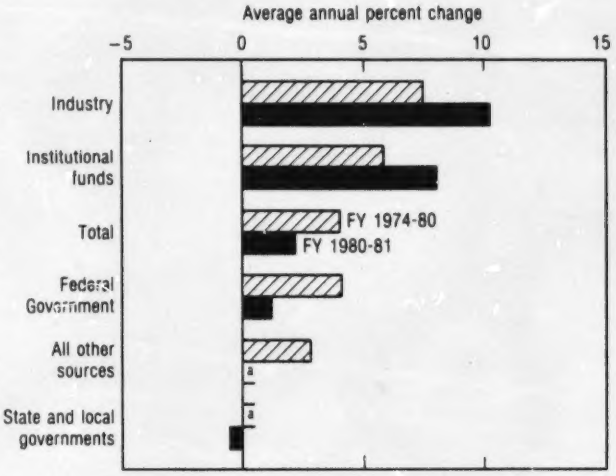
- In addition to the $6.8 billion spent for research and development by universities and colleges, $2.5 billion was spent by their affiliated federally funded research and development centers (FFRDC's) in 1981, up 11 percent over 1980, just above the level of inflation. As in previous years, about three-quarters of these funds were concentrated in the physical sciences and engineering.

Sources of R&D Support

Federally financed academic R&D spending, which constituted about two-thirds of total R&D expenditures, continued to climb in 1981 reaching $4.5 billion, an 11-percent current-dollar increase, but inflation cut this to a 1-percent rise in real dollars (chart 2). This was markedly lower than the 4-percent average annual rate of real growth of universities' expenditures of Federal funds for research and development from 1974 to 1980. The 1980-81 slowdown follows a 1-percent decline in constant dollars in Federal R&D obligations in 1980. Since Federal academic R&D obligations declined another 3 percent in real dollars in 1981, institutions are expected to report a continuation in this leveling trend in 1982.[3] A constant-dollar decline in Federal academic R&D support of 4 percent is reflected in the Budget for 1982[4] while a 2-percent to 3-percent increase is expected for 1983.[5]

The $2.2 billion received by universities from non-Federal sources for R&D activities, accounting for one-third of academic R&D spending, rose more than 4 percent in real dollars in 1981. All of the rise in non-Federal R&D support can be attributed to increases in industry and institutional funds, up 10 percent and 8 percent, respectively, in constant dollars (chart 2). The $285 million from industry, however, accounted for only 4 percent of total academic R&D spending, showing little change in relative share since 1974, in spite of increasing university/industry collaborative research efforts in science and engineering. Institutions' own funds ($974 million) accounted for a 14-percent share of total expenditures in 1981. State and local government funding (8 percent of the total) and all other sources including foundations and voluntary health agencies (7 percent of the total) showed virtually no real growth in 1981.

Chart 2. R&D expenditures at universities and colleges by source of funds
(Based on 1972 constant dollars)



[a]Less than 0.5 percent change.
SOURCE: National Science Foundation

Character of Work

Academic basic research expenditures rose 14 percent in 1981, or 3 percent in constant dollars, matching the 3-percent average annual growth rate reported since 1974. Of the $4.6 billion expended on basic research, 71 percent was provided by the Federal Government, led by the Department of Health and Human Services (primarily the National Institutes of Health) and NSF.[6] Historically, universities and colleges have performed about one-half the Nation's basic research; this proportion remains unchanged in 1981. Basic research accounted for a 67-percent share of academic R&D spending in 1981, down from 71 percent in 1974, indicating a slight shift over time toward applied research and development. Little growth occurred, however, in expenditures for applied research activities in 1981—less than 1 percent in real terms—a considerable decrease from the 7-percent per year real-dollar increase from 1974 to 1980.

[3]National Science Foundation, *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1981* (Final Report) (Washington, D.C., 1983), table B-5 (in press).

[4]National Science Foundation, *Federal Funds for Research and Development* (Detailed Historical Tables: Fiscal Years 1967-1983) (Washington, D.C., December 1982), table 11B, p. 106 (unpublished).

[5]Office of Management and Budget, unpublished data, January 1983.

[6]National Science Foundation, *Federal Funds for Research and Development: Federal Obligations for Research to Universities and Colleges by Agency and Detailed Field of Science, Fiscal Years 1973-1983* (Washington, D.C., December 1982), table 2B, pp. 55-72 (unpublished).

Fields of Science and Engineering[7]

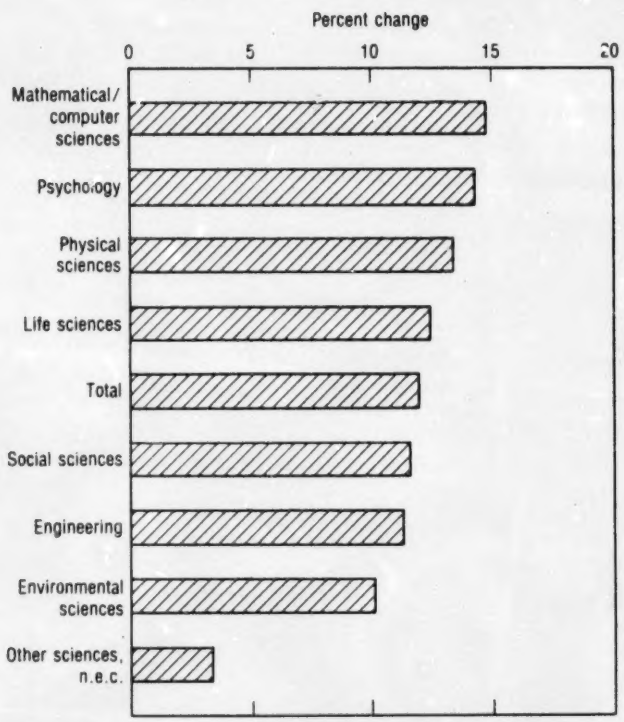
R&D spending in all major S/E fields either exceeded or equaled the 10-percent inflation rate in effect from 1980 to 1981 (chart 3). The largest 1980-81 growth rates were reported for mathematical/computer sciences and psychology, up 15 percent and 14 percent, respectively, mainly attributable to increases in Federal funding which accounted for more than 70 percent of total expenditures in these fields. The growth in 1981 expenditures for research and development in the physical and life sciences, up 12 percent to 13 percent, although below that of mathematical/computer sciences and psychology, accounted for nearly two-thirds of the total 1981 dollar increase reported for all fields combined. Growth in engineering and social and environmental sciences kept pace with inflation but fell slightly below the growth rate for all disciplines combined.

Largest R&D Performers

The 100 largest academic R&D performers expended $5.6 billion in 1981, or 83 percent of the R&D total and 84 percent of federally financed expenditures, about the same shares reported for the past decade. Twelve of the leading 20 R&D-performing institutions reported expenditures exceeding $100 million in 1981 (table 1); 13 of the 20 reported real growth in R&D spending.

[7]Data from the University of California (UC) campuses were not included in the percentages reported in this section. At the time this report went to press, S/E field data from the UC system were not finalized.

Chart 3. R&D expenditures at universities and colleges by field[a]: FY 1980-81



[a]Data from the University of California (UC) campuses were not incorporated into the percentages shown in this chart. At the time this report went to press, S/E data from the UC system were not finalized.
SOURCE: National Science Foundation

Table 1. Twenty institutions reporting the largest R&D expenditures in the sciences and engineering: FY 1981[1]

[Dollars in millions]

Institution	Total		Federal	
	FY 1981	Percent change, FY 1980-81	FY 1981	Percent change, FY 1980-81
Total, all institutions	$6,793	12	$4,549	11
Total, leading 20 institutions	2,415	12	1,810	10
1. Johns Hopkins Univ.[2]	270	7	257	7
2. MIT	184	13	152	10
3. Univ. of Wisconsin-Madison	148	7	96	8
4. Univ. of Calif.-San Diego	138	10	119	7
5. Univ. of Michigan	133	20	84	12
6. Univ. of Minnesota	133	12	78	14
7. Stanford Univ.	130	15	117	14
8. Univ. of Washington	125	12	104	12
9. Cornell Univ.	123	15	82	16
10. Harvard Univ.	[3]112	11	85	11
11. Univ. of Pennsylvania	104	11	80	14
12. Columbia Univ.	101	-1	85	2
13. Univ. of Calif.-Berkeley	99	9	66	3
14. Univ. of Calif.-Los Angeles	97	9	74	5
15. Univ. of Illinois-Urbana	93	12	57	8
16. Univ. of Calif.-San Francisco	89	21	73	19
17. Yale Univ.	84	18	74	16
18. Texas A&M Univ.	84	18	38	21
19. Univ. of Calif.-Davis	84	23	39	12
20. Univ. of Texas at Austin	82	5	49	2
Total, all other institutions	$4,378	13	$2,739	12

[1]Data do not include R&D performed by university-administered federally funded research and development centers.
[2]Includes Applied Physics Laboratory.
[3]Estimate.

SOURCE: National Science Foundation

Research Equipment Expenditures

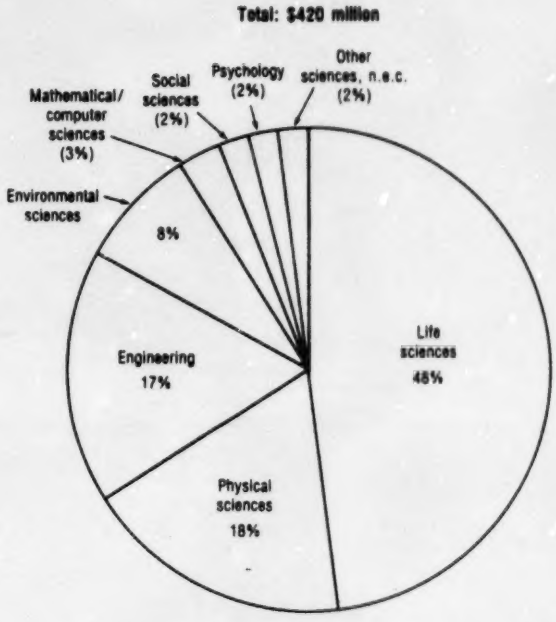
Separately budgeted R&D expenditures by universities for S/E research equipment were up an estimated 15 percent in 1981 to approximately $420 million, constituting a 6-percent share of total academic R&D spending—the same share reported in 1980.[a] Of this total, almost two-thirds were federally funded equipment expenditures. As with R&D performance, research equipment expenditures were highly concentrated, with 20 institutions accounting for more than one-third of the total in 1981; expenditures for engineering equipment alone were even more concentrated with one-half of all funds coming from 20 institutions. Thirteen of the leading 20 universities were also among the top 20 R&D performers listed in table 1. Nearly one-half of all academic research equipment expenditures in 1981 went for the life sciences (chart 4).

* * * * * * *

The report **Academic Science: R&D Funds, Fiscal Year 1981** (Detailed Statistical Tables) (NSF 83-308) (in press) can be obtained from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550. For more information on the availability of data tapes, call (202) 634-4673.

[a]Data collected in 1980 were requested in an "optional" item which became a standard part of the 1981 questionnaire. The imputation rates were four-times higher for this item in 1980 than they were in 1981, and thus the 1-year changes are subject to careful interpretation.

Chart 4. Distribution of separately budgeted R&D expenditures for research equipment by field: FY 1981



SOURCE: National Science Foundation

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